Sudbury Neutrino Observatory Prompt Off-line Monitoring and Analysis

C.E. Okada, A.W.P. Poon, Y.D. Chan, X. Chen, M. Dragowsky, K.T. Lesko, A. Marino, E.B. Norman, T. Okui, A. Schülke, R.G. Stokstad

It is often desirable to execute some immediate processing of the data arriving from the detector to get a picture of its general health and stability. One hopes that the detector will operate in a stable manner throughout its lifetime, however, changes in performance will most certainly occur, and must be corrected in the hardware or accounted for in the data analysis. These changes can be either sudden or gradual, so a monitoring system which includes both a prompt analysis and archive history are needed. These requirements are accomplished by taking "snapshots" of the detector which can be quickly compared.

In order spot sudden changes in the detector, we need to process the data quickly. For this stage, a full analysis of the raw data is not necessary, and the production of some simple, low–level tables and histograms should be sufficient. At the moment, items which are being considered for this process includes the detector configuration, total event rate, rates of different triggers, and rates of triggers from each PMT. Upon arrival of a data tape, a process (the SNO Run Examination — SNORE) is started which automatically runs through all of the data files and produces the necessary statistics for each file. A typical data tape covers about a week's worth of operation, and data file represents a couple of hours.

The output of the SNORE process is a set of files (tables, pictures and HBOOK files) which are linked together with an HTML interface for access via web browsers. A search interface is also being developed to allow a user to find a particular set of data.

After the raw data file has been examined by the SNORE processor, it will be passed through a "first–pass" processor (FPP), which is being developed here at Berkeley. The function of this processor is to remove unphysical backgrounds in the data before applying the event reconstruction, which is computationally intensive. One type of these backgrounds is the "orphans", which are problematic events identified by the event builder. Events that generate a trigger in the detector after the detector has been triggered (locked out) by another event are also stored in the raw data. These "missed–trigger" events are removed by the FPP. Electronic noise would cause the detector to re–trigger immediately after the previous trigger. These re–triggers are also removed by the FPP. The SNO photomultiplier tubes are known to emit light intermittently ("flashers"). These flashers show distinct signatures in the SNO electronic system, and can be removed easily by the FPP. If the detector is shown to be running in a stable manner by the SNORE processor, the Pulsed Global Trigger (PGT) events are also removed from the raw data. The PGT events are triggered by a pulser at regular time interval, thereby taking snap–shots of the detector. These events are important to understanding the running behavior of the detector, but are backgrounds in the energy spectrum.

The algorithms for these cuts in the FPP have been developed and are being fine–tuned at the moment. SNO air–fill and partial–fill data, and Monte Carlo simulations are used to fine–tune the FPP. These on–going analyses will enable us to understand the efficiencies and the correlations of the cuts in FPP, as they are important in assessing the systematic uncertainties in the neutrino physics analyses.